NON-PUBLIC?: N
ACCESSION #: 8805180070
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Byron, Unit 1 PAGE: 1 of 5

DOCKET NUMBER: 05000454

TITLE: Reactor Trip Due To Rod Drop During Manual Control Rod Motion
EVENT DATE: 04/18/88 LER #: 88-002-00 REPORT DATE: 05/13/88

OPERATING MODE: 1 POWER LEVEL: 098

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Lee Sues, Assistant Superintendent Technical Services
TELEPHONE #: 815-234-5441 Ext. 2214

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT: At 2120 on April 18, 1988, a licensed reactor operator manually inserted the controlling bank of control rods one step to adjust Axial Flux Difference. The "Power Range Flux Rate High Reactor Trip" annunciator actuated and the reactor trip breakers opened. Control room operators entered and complied with "Reactor Trip or Safety Injection Unit 1 Emergency Procedure". The Auxiliary Feedwater Pumps started due to low-low steam generator levels that resulted from the trip at high power. Stable plant conditions were achieved in Hot Standby at 2230 on April 18, 1988.

The intermediate cause of the reactor trip was the dropping of one or more control rods into the reactor core, which resulted in the flux high negative rate reactor trip. Troubleshooting efforts failed to determine a root cause of the dropped rods. It is believed that an intermittent component failure in the rod control system caused the event, but the component did not remain in the failed mode following the reactor trip.

Extensive troubleshooting was conducted to locate discrepancies that may have caused the rod drop. A number ofloose electrical connections were identified in the rod control power cabinets and all were repaired. Movable gripper coil and lift coil power bridge thyristors were replaced in the 2BD power cabinet due to their likelihood of causing this event. On April 21, 1988, all approvals required to start up the plant following a reactor trip for which no root cause has been determined, were obtained and the

plant entered the Startup operational mode.

Previous occurrences of reactor trips caused by dropped rods are documented in Licensee Event Reports 85-042, 85-063 and 86-028.

(End of Abstract)

Energy Industry Identification System (EIIS) codes are identified in the text as (xx)

A. PLANT CONDITIONS PRIOR TO EVENT:

Event Date/Time 4/18/88 / 2120

Unit 1 MODE 1 - Power Operations Rx Power 98%
RCS (AB) Temperature/Pressure Normal Operating

B. DESCRIPTION OF EVENT:

There were no systems or components inoperable at the beginning of this event that contributed to this event.

As a result of routine monitoring of main control board instrumentation, a licensed reactor operator noted that indicated Axial Flux Difference (delta I), which is derived from the Power Range Nuclear Instruments (IG), was not on the desired target value. Although the Byron Technical Specifications permit unrestricted plant operation as long as delta I is maintained within a prescribed band on either side of the target valve, it is Byron operating policy to maintain delta I at the target value, if plant conditions allow. The indicated delta I could be corrected to the target value in this case by partially inserting the Control Bank D rods from their withdrawn position of 219 steps. At 2120 on April 18, 1988, the reactor operator moved the Rod Drive (AA) Selector Switch from the AUTOMATIC position to the MANUAL position, and pushed the Rod Drive In-Hold-Out switch to drive the Control Bank D Group 2 rods in one step. "Rod at Bottom" and "Digital Rod Position Indication Urgent Failure" printed on the Sequence of Events Recorder. Power Range Nuclear Instrumentation measured a high negative flux rate condition on two of four channels. The "Power Range Flux Rate High Reactor Trip" annunciator alarmed and a reactor trip occurred. The control room operators entered and complied with "Reactor Trip or Safety Injection Unit 1 Emergency Procedure" (1BEP-O). A Rod Control urgent failure alarm followed the opening of the reactor trip breakers due to expected voltage regulation failures in all Rod Drive (AA) power cabinets,

however, no rod control urgent failure alarms actuated prior to the reactor trip. The lack of urgent failure alarms prior to the rod drop suggested blown rod control power cabinet gripper fuses as a possible cause. Operators were dispatched to inspect for blown fuses, but all fuses were determined to be intact.

At 2122 the 1A and 1B Auxiliary Feedwater Pumps (BA) (AFP) started automatically due to low-low steam generator levels. A Feedwater Isolation Signal (FWIS) occurred due to the Reactor Trip and low Reactor Coolant average temperature (T(avg)). These Engineered Safety Feature (ESF) actuations are expected following a Reactor Trip from high power level. At 2148, the Start-up Feedwater Pump (SJ) was started, the FWIS was reset, and a flowpath was aligned to the steam generators from the Start-up Feedwater Pump. At 2157 the 1B AFP was stopped and at 2230 the 1A AFP was stopped. All operator actions taken during this event were correct and contributed to the safe conclusion of this event. Stable plant conditions were achieved in Hot Standby (Mode 3) by 2230 on April 18, 1988.

This Licensee Event Report (LER) is submitted in accordance with 10CFR50.73(a)(2)(iv) due to the automatic ESF actuations.

C. CAUSE OF EVENT:

The intermediate cause of the reactor trip was the dropping of one or more control rods into the reactor core, which resulted in the flux high negative rate reactor trip. It could not be determined how many rods dropped or specifically which rods dropped due to the rapid progression of the event and the unavailability of the Process Computer (ID) Alarm Typer, which was mechanically jammed. The Alarm Typer may have indicated specific rod misalignments in the early stages of the event. This information would have focused the troubleshooting effort following the reactor trip. Extensive troubleshooting efforts failed to determine a root cause of the dropped rods, however, minor rod control system discrepancies were corrected as documented in the Corrective Actions section of this report. It is believed that an intermittent component failure in the rod control system caused the event, but the component did not remain in the failed mode following the reactor trip.

D. SAFETY ANALYSIS:

All ESF systems actuated and performed as designed. The Reactor Protection System (JG) responded properly to a power range flux high negative rate condition sensed by two of the four power range nuclear

instruments. The AFP's automatically started due to low-low steam generator levels that resulted following the reactor trip from high power. Plant/public safety were not affected by this event.

E. CORRECTIVE ACTIONS:

Immediately following the reactor trip on April 18, 1988, the rod control power cabinet gripper fuses were inspected for blown fuse indicators and the Process Computer Alarm Typer jam was cleared. No blown fuse indicators were actuated. By 2300 on April 18, 1988, rod drive system conditions at the time of the reactor trip had been fully researched and documented, and detailed troubleshooting efforts were commenced by Technical Staff engineers and Instrument Maintenance (IM) technicians. Rod drive power cabinet circuit cards were tested and no failures were identified. The voltage outputs of all Direct Current (DC) power supplies in each power cabinet were checked and determined to be satisfactory. At 0205 on April 19, 1988, IM technicians checked all stationary gripper coil fuses to determine if any had failed without triggering the appropriate blown fuse indicator. All fuses were intact.

On the afternoon of April 19, 1988, Byron Station management requested technical assistance from the Braidwood Station Technical Staff and the Braidwood Westinghouse Site Engineering Team due to their recent experience in rod control system problems. Also, Byron Station's management requested that Westinghouse provide a rod control system technical expert to assist in the investigation.

At 2320 on April 19, 1988, alarm circuitry was tested to determine if a rod control urgent failure condition could exist in a power cabinet and not generate the associated alarm. All alarm circuitry functioned properly during the test.

At 0115 on April 20, 1988, a temporary change to the "Checkout of the Bank Overlap Unit Surveillance Procedure" (1BVS XPT-2) was performed. This modified procedure permitted exercising of the control rods while strip chart recorders monitored the following information:

1. V(ref) (reference voltage)
2. V(es) (saturation voltage)
3. V(err) (error voltage)
4. V(rip) (ripple voltage)
5. Stationary gripper coil voltage - mechanism #1

E. CORRECTIVE ACTIONS: (Continued)

6. Lift coil voltage - mechanism #1
7. Moving coil voltage - mechanism #1
8. Moving coil voltage - mechanism #2
9. Moving coil voltage - mechanism #3
10. Moving Phase Control, Phase A
11. Moving Phase Control, Phase B
12. Moving Phase Control, Phase C

The modified 1BVS XPT-2 was approved by station management with the understanding that this was an unusual system configuration that presented a high risk for rod drops during the testing. While testing power cabinet 2BD (power to Control Bank D Group 2 rods) at 0400 during the first execution of the modified 1BVS XPT-2, a rod control urgent failure alarm actuated due to a moving phase failure. IM technicians pulled the circuit card frame out of the 2BD power cabinet to inspect for faulty electrical connections on the frame. While inspecting, two of the DC power supplies were shorted to ground, and the partially withdrawn control rods powered by the 2BD power cabinet dropped to the bottom of the core. The power cabinet alignment was restored and the rods were again withdrawn. Attempts to repeat the rod control urgent failure were unsuccessful.

At 1200 on April 20, 1988, the voltages for the lift coils, stationary gripper coils and movable lift coils supplied by the 2BD power cabinet were determined to be acceptable. The line voltages of the rod drive motor-generator sets were checked and were acceptable. At 1830 movable gripper coil currents were measured in all power cabinets by forcing the bridge thyristors to conduct. All currents measured normal and steady. At 2047 all power cabinets were deenergized, and Electrical Maintenance (EM) technicians checked all electrical connections in the power cabinets for tightness. A total of forty-eight loose connections were located and tightened or repaired. Power cabinet electrical connections in the bus ducts were also checked.

At 2120 on April 20, 1988, all movable gripper coil and lift coil power bridge thyristors were removed from the 2BD power cabinet and replaced with thyristors from spare parts. This action was taken due to the dropped rod symptoms and the potential for thyristor intermittent failure. Sampling resistor connections in all power cabinets were checked. IM technicians cleaned and tightened the circuit card edge connectors in the 2BD power cabinet. At 0930 on April 21, 1988, the power cabinets were energized and strip chart traces of the twelve parameters tabulated previously in this report section were analyzed. No abnormal conditions were indicated.

On April 21, 1988, all approvals required to start up the plant following a reactor trip for which noroot cause has been determined, were obtained and the plant entered the Startup Operational Mode (Mode 2) at 1149.

The "Operating Shift Turnover and Relief Administrative Procedure" (BAP 335-1) will be revised to include a check for normal condition of the Process Computer alarm Typer by the NSO. Implementation of this revision is tracked by Action Item Record 454-225-88-0102.

F. PREVIOUS OCCURRENCES:

Reactor trips due to rod drops have occurred previously as described in the following LER's:

LER NUMBER TITLE

85-042 (Unit 1) Reactor Trips Due to Dropped Rods
85-063 (Unit 1) Reactor Trip Due to Turbine Trip Above P-7
86-028 (Unit 1) Manual Reactor Trip Due to Rod Drop
Caused by Faulty Circuit Cards

Root causes were determined in all of these dropped rod incidents and appropriate corrective actions were taken.

G. COMPONENT FAILURE DATA:

a) MANUFACTURER NOMENCLATURE MODEL NUMBER MFG PART NUMBER

Not Applicable

b) RESULTS OF NPRDS SEARCH:

Not Applicable

Commonwealth Edison
Byron Nuclear Station
4450 North German Church Road
Byron, Illinois 61010

DATE: May 13, 1988

LTR: BYRON 88-0488

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Dear Sir:

The enclosed Licensee Event Report from Byron Generating Station is being transmitted to you in accordance with the requirements of 10CFR50.73(a)(2)(iv).

This report is number 88-002; Docket No. 50-454.

Very truly yours,
/s/ R. Pleniewicz
R. Pleniewicz
Station Manager
Byron Nuclear Power Station

RP/RJP/bb (1921M/0206M)

Enclosure: Licensee Event Report No. 88-002-00

cc: A. Bert Davis, NRC Region III Administrator
P. Brochman, NRC Senior Resident Inspector
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